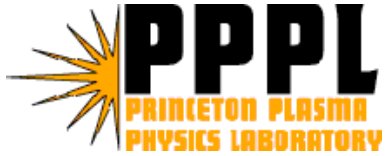
Welcome to the Warm Dense Matter Winter School*



B. Grant Logan

Lawrence Berkeley National Laboratory and

Director, Heavy Ion Fusion Sciences Virtual National Laboratory

Warm Dense Matter School

10-16 January, 2008

Berkeley, California, USA

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Welcome

1. Thank you all for coming
2. This is a distinguished group of scientists and students coming from all over the world (since this is a new field we are all students). This international group includes 46 from the USA, 25 Japanese, 5 Chinese, 4 Canadian, 3 Russian, 2 Romanian, 2 German, 1 Korea, 1 French, 1 Israeli
3. The field of Warm Dense Matter is growing. One indicator: the school was originally expecting to attract approximately 30 - 40 participants. At last count there were 90 registrants

Warm Dense Matter Research has a wide reach

Warm Dense Matter science touches:

- **-- Astrophysics and geophysics (stellar and planetary interiors)**
- **-- Industrial applications such as laser machining or the physics of conventional explosions**
- **-- Inertial confinement fusion, setting the early stage initial conditions and helping describe effects of the blast in the chamber**
- **....**

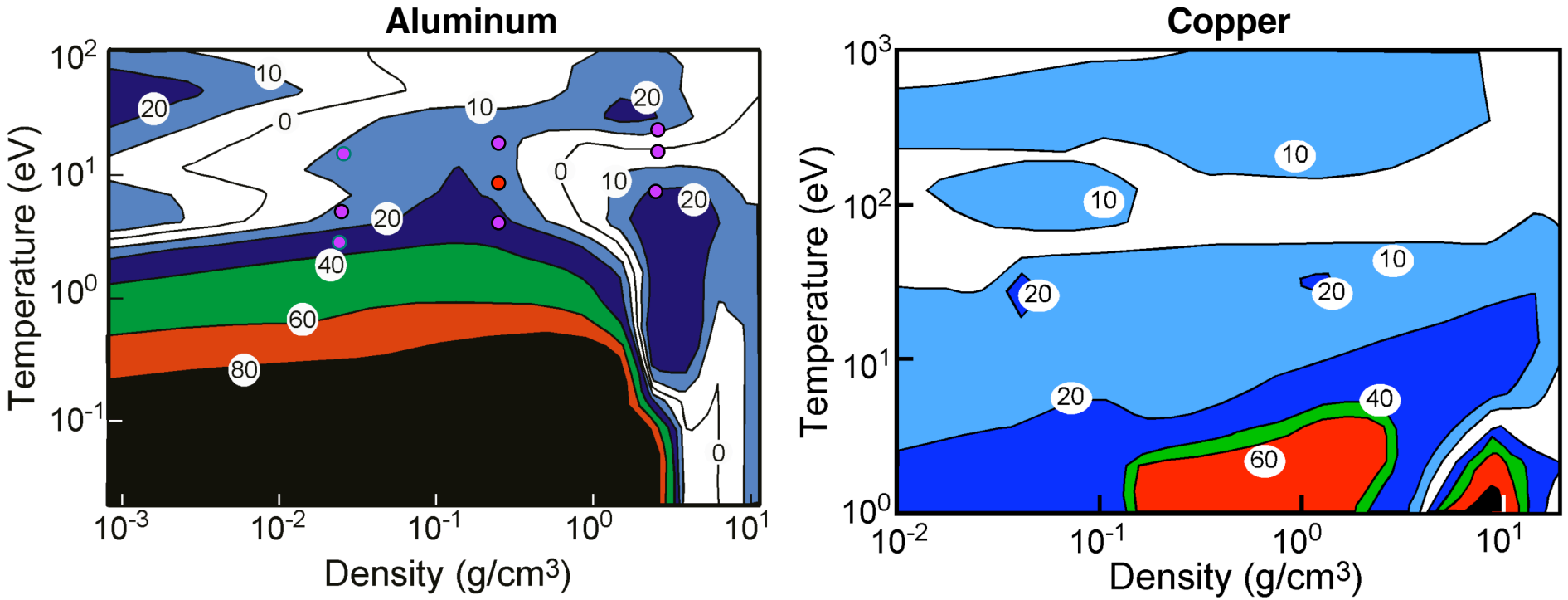
Warm Dense Matter can be created by

- **-- Lasers or x-rays**
- **-- Ion or electron beams**
- **-- Pulsed electrical currents**

Each method has unique advantages.

There is much to be learned!

Contours of % differences in pressure



In Warm Dense Matter large uncertainties exist even for the best studied materials

- EOS Differences > 80% are common
- Measurements are *essential* for guidance
- Where there is data the models agree!!
  - Data is along the Hugoniot - single shock ρ-T-P response curve

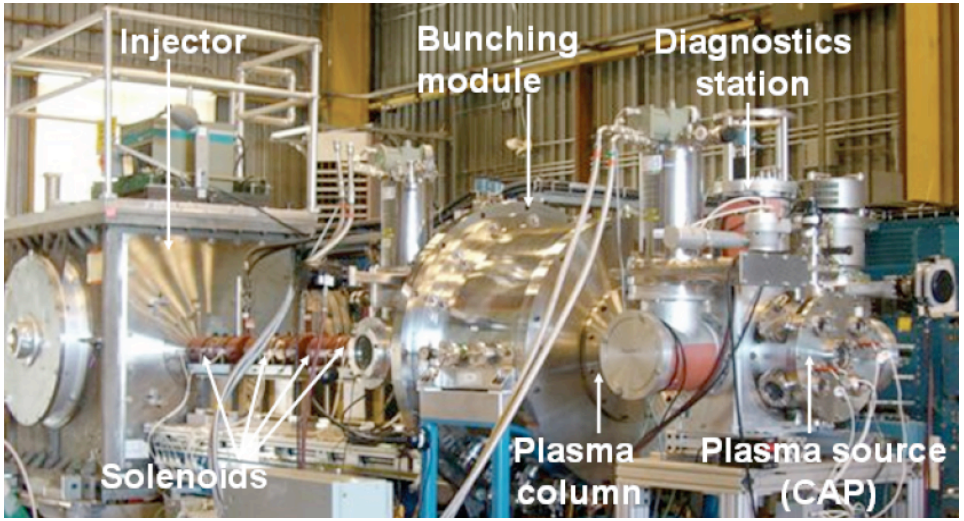
(figures courtesy R. Lee, LLNL)

A word from our sponsors

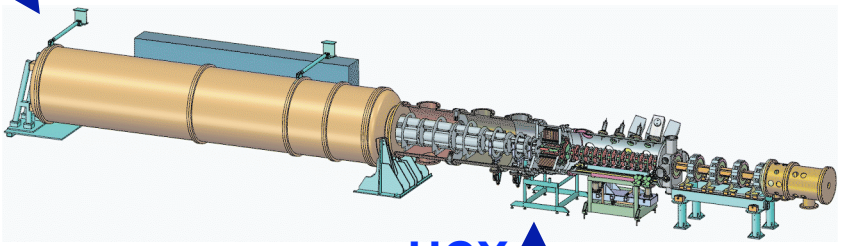
The school is sponsored by:

1. **The Heavy Ion Fusion Science Virtual National Laboratory (LBNL, LLNL, PPPL, B. Grant Logan, Director)**
2. **The University of California's Institute for Material Dynamics at Extreme Conditions (IMDEC, Roger Falcone, Director)**
3. **The Japanese JSPS Core-to-Core Program "International Collaboration for High Energy Density Science" (represented here by Hitoki Yoneda)**
4. **LLNL's Physical Science Directorate (Bill Goldstein, Associate Director)**

The Heavy Ion Fusion Science Virtual National Laboratory is focused on WDM on a path to IFE



Today:



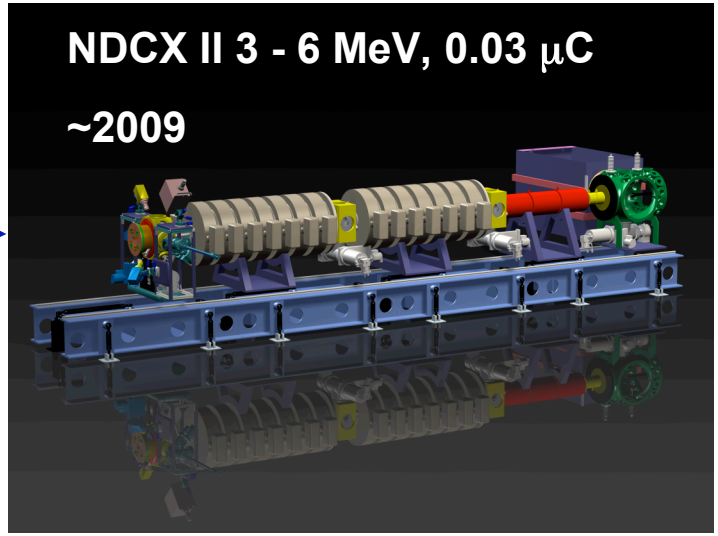
HCX

1.7 MeV, ~0.025 μC

NDCX I

0.4 MeV, 0.003 μC Initial WDM expts

Soon →



Future

IB-HEDPX (with CD0)
5 - 15 year goal
20 - 40 MeV, 0.3 - 1.0 μC
WDM User facility

10 kJ Machine for HIF
10 - 20 year goal
Target implosion physics

Francis Thio sends his encouragement

Dr. Francis Thio, the Department of Energy, Office of Fusion Energy Sciences, program leader for High Energy Density Physics, sends us this statement:

"I would like to add my welcome to you all to this First Winter School in Warm Dense Matter. Judging by its program, the coming week promises to be a very engaging week of high intellectual content. How I wish I could be among you to listen to and enjoy these lectures with you. The study of Warm Dense Matter is a part of a larger field of the science of high energy density matter. The study of Warm Dense Matter is important to inertial fusion energy sciences and to nuclear stockpile stewardship. In each area, ordinary condensed matter is compressed to exceedingly high energy density in order to achieve its goals. The compression trajectory necessarily takes the initial condensed matter through states which we call Warm Dense Matter. As you will learn from this School, there remain great uncertainties or gaps in our knowledge of the physics of these states of matter. It is important that we have better knowledge of these states of matter in order for us to do the job for inertial fusion energy sciences and nuclear stockpile stewardship well. Furthermore, as you will learn from the School, in the states space, Warm Dense Matter is the meeting ground of the physics of condensed matter and hot dense plasmas. In this region of the states space, the interactions among the particles often involve strong quantum, electric and magnetic fields, combined with radiative energy transfer, hydrodynamics and magnetic diffusion in heating and ionizing materials, give rise to a physical complexity that ought to be a fertile ground for exciting scientific discoveries. Whether this vision will be realized and Warm Dense Matter stands as a science on its own right remain to be seen, and is largely in your hands as the future ground-tiller of this field! You need to make the case for it. With that, let me wish you all a very rewarding week at the School and all the best in your future endeavors in this field."

Acknowledgements

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